The Comprehensive Everglades Restoration Plan

Aquifer Storage and Recovery Program Status Update

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Director
United States Environmental Protection Agency, South Florida Office

South Florida Ecosystem Restoration Task Force, June 7, 2002

The Comprehensive Everglades Restoration Plan (CERP)
Aquifer Storage and Recovery (ASR) Program

The Recommended Plan
(Alternative D13R)

Lake Okeechobee ASR
Approximately 200 Wells
Located in Glades and Okeechobee Counties

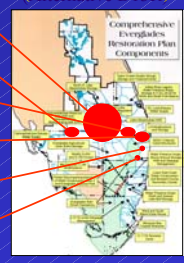
C-43 Basin ASR
Approximately 44 Wells
Located in Hendry, Glades, and Lee Counties

L-8 Basin ASR
Approximately 10 Wells
Located in Palm Beach County

C-51 Basin ASR
Approximately 34 Wells
Located in Palm Beach County

Palm Beach Agricultural Reserve Reservoir ASR
Approximately 15 Wells
Located in Palm Beach County

Western Hillsboro Canal Basin ASR
Approximately 30 Wells
Located in Palm Beach County



for a total of 333 wells … pending further study and pilot testing

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The Comprehensive Everglades Restoration Plan (CERP)
Aquifer Storage and Recovery (ASR) Program

The Recommended Plan included
3 pilot projects

Lake Okeechobee ASR Pilot

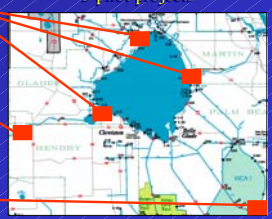
- One 5 mgd ASR well at each location.
- One of the three sites with two additional 5 mgd ASR wells.

Caloosahatchee River ASR Pilot

- One 5 mgd ASR well.

Hillsboro ASR Pilot

- Three 5 mgd ASR wells.



How are ASR wells regulated?

ASR wells are regulated as Class V injection wells, one of five classes of injection wells regulated under the Underground Injection Control (UIC) Program of the Federal Safe Drinking Water Act. The SDWA aims to protect sources of drinking water from contamination due to human activities by preventing any activities that would endanger an existing or potential future source of drinking water.

The term "endangerment" in the context of injection practices is defined in Section 1421 (D)(2) of the SDWA; "Underground injection endangers drinking water sources if such injection may result in the presence in underground water, which supplies or can reasonably be expected to supply any public water system, of any contaminant, and if the presence of such contaminant may result in such system's not complying with any national primary drinking water regulation or may otherwise adversely affect the health of persons."

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How are ASR wells regulated…

The UIC program for Class I, III, IV, and V wells in the State of Florida, with exception of injection wells on Native American lands is administered by the Florida Department of Environmental Protection (FDEP), as approved by EPA pursuant to section 1422 of the SDWA, of Underground Injection "Control Program" and accompanying certifications, signed by General Counsel for the FDEP, January 14, 1982.

Correspondingly, ASR wells fit the technical definition of an injection well and are regulated in accordance with the SDWA, under Florida's UIC program as Class V, Group 7 injection and recovery wells, unless they are used to store and recover effluent or reclaimed water from a domestic wastewater treatment plant (the latter are classified as Class V, Group 3 wells).

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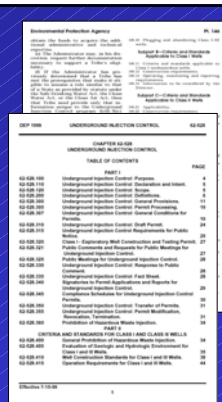


ASR in the CERP

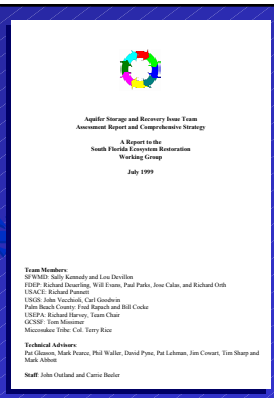
While CERP budgeted for facilities capable of treating water to levels compliant with drinking water standards prior to injection, it has been noted that considerable savings could be realized if the requirements of the SDWA could be satisfied with lesser levels of treatment.

Recognizing that substantial regional water storage capacity is needed for ecosystem restoration, USEPA has been working with the FDEP in consideration of a flexible "risk-based" approach to ASR well construction and permitting. Because it is a delegated program, the USEPA has review authority over any modifications to Florida's UIC program. Likewise, implementation of such an approach cannot be initiated without the FDEP's and USEPA's approval of UIC program modifications that might result from the supporting, ongoing research.

This approach aims to prevent endangerment of Florida's USDWs while reducing the financial cost of CERP ASR.

Recognizing the potential for CERP to benefit from ASR, and recognizing that numerous complex issues would need to be addressed in the process, the South Florida Ecosystem Restoration Task Force Working Group formed an ASR Issue Team in 1998.

In 1999, the Aquifer Storage and Recovery Issue Team produced a report as directed by the South Florida Ecosystem Restoration Task Force Working Group identifying issues to be more definitively evaluated via the CERP ASR program, as well as strategies to help resolve those issues.



Aquifer Storage and Recovery Issue Team
Assessment Report and Comprehensive Strategy

A Report to the
South Florida Ecosystem Restoration
Working Group

July 1999

Team Members:
SFWMD: Sally Kennedy and Lou Dervillon
FDEP: Richard Deuerling, Will Evans, Paul Parks, Jose Calas, and Richard Orth
USACE: Richard Punnett
USGS: John Vecchioli, Carl Goodwin
Palm Beach County: Fred Rapach and Bill Cocke
USEPA: Richard Harvey, Team Chair
GCSSF: Tom Missimer
Miccosukee Tribe: Col. Terry Rice

Technical Advisors:
Pat Gleason, Mark Pearce, Phil Waller, David Pyne, Pat Lehman, Jim Cowart, Tim Sharp and Mark Abbott

Staff: John Outland and Carrie Beeler

The report can be found at: http://www.sfrestore.org/issueteams/asr/documents/asrreport.htm

Identified issues:

1. Characterization of the quality of prospective source waters, spatial and temporal variability
2. Characterization of regional hydrogeology of the Upper Floridan Aquifer: hydraulic properties and water quality
3. Analysis of critical pressure for rock fracturing
4. Analysis of site and regional changes in head and patterns of flow
5. Analysis of water quality changes during movement and storage in the aquifer
6. Aquifer storage and recovery potential effects on mercury bioaccumulation for ecosystem restoration projects
7. Relationship between ASR storage interval properties and recovery rates and recharge volume

Issues 1, 2, 4, 5, and 7 were identified as carrying the highest degree of concern. However all issues were planned to be addressed as part of CERP ASR Pilot Projects at the time this report was prepared.

Strategies recommended to address identified issues include:

1. Characterize source waters for a variety of parameters including drinking water standards and other contaminants reasonably expected to be found in the source water
2. Recommendations for exploratory and test drilling protocols necessary to characterize Floridan Aquifer System geologic and water quality properties.
3. Utilize documented methods with gathered field data to estimate fracture pressures.
4. Obtain field data necessary to model variable density flow on local and regional bases, and employ such models to simulate regional and site-specific changes in head and ground water flow

(more)

and…

5. Monitor storage zone and recovered water quality during all phases of ASR and test for a variety of parameters including pathogens, pesticides, metals, and organic compounds detected in source waters.
6. Monitor recovered water, and evaluate the fate of recovered water and its effects on receiving biologic systems via mathematical simulation or other means .
7. Evaluate performance of existing ASR facilities; conduct pilot testing of CERP ASR Pilot wells; characterize water quality and (ecosystem, urban, and agriculture) volumetric requirements; and develop methods and protocols for cycle-testing, storage zone testing, and addressing operational problems that might be encountered.

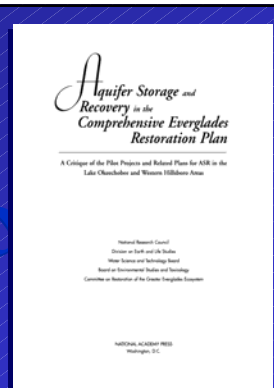
Input from the ASR Issue Team was considered during development of the Lake Okeechobee ASR Pilot and Hillsboro ASR Pilot draft project management plans.

Recommendations for site-specific investigations were integrated into the draft pilot project management plans, but recommendations for regional investigations were not.

The Lake Okeechobee ASR Pilot and Hillsboro ASR Pilot draft project management plans were released for comment in 2000.

In 2000, members of the Committee on Restoration of the Greater Everglades Ecosystem participated in a workshop to review draft project management plans for the Lake Okeechobee Aquifer Storage & Recovery Pilot, and the Hillsboro Aquifer Storage & Recovery Pilot.

Issues raised at the workshop are documented in a report published in 2001. Like the ASR Issue Team report, the CROGEE report also contained recommendations to help resolve identified issues.



Aquifer Storage and Recovery in the Comprehensive Everglades Restoration Plan

A Critique of the Pilot Projects and Related Plans for ASR in the Lake Okeechobee and Western Hillsboro Areas

National Research Council
Division on Earth and Life Studies
Water Science and Technology Board
Board on Environmental Studies and Toxicology
Committee on Restoration of the Greater Everglades Ecosystem

NATIONAL ACADEMY PRESS
Washington, D.C.

The report can be found at: http://www.nap.edu/catalog/10061.html

Identified issues and recommendations are grouped into three topics:

Data beyond the local geographic scope of the pilot projects is needed
- A data needs analysis should be conducted
- Data of a regional nature should be collected and evaluated
- Regional density dependent ground water flow models should be developed

Additional information about water-rock-ecosystem interactions is needed
- Ecological studies need to be conducted to see how the ecosystem will respond to ASR
- A better understanding of source water chemistry is needed
- Laboratory studies are needed to evaluate subsurface chemical processes
- Studies aiming to help understand subsurface mixing dynamics are necessary

Additional site-specific investigations necessary to support regional investigations are necessary
- Enhanced monitoring well networks at each pilot well site are needed
- A comparison of well designs and their relationship to well operation is needed
- Long-duration injection and storage studies at the Lake Okeechobee sites are needed
- Development and refinement of conceptual and numerical models for predicting "bubble" migration is needed

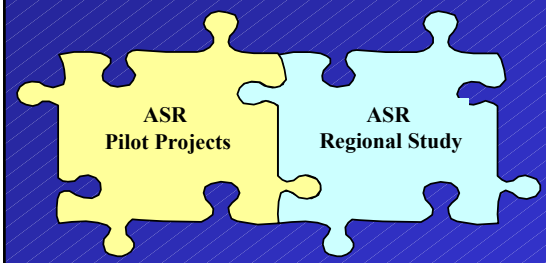
Input from the CROGEE was considered during finalization of the Lake Okeechobee ASR Pilot and Hillsboro ASR Pilot Project Management Plans.

Recommendations for site-specific investigations were integrated into the final pilot project management plans, but recommendations for regional investigations were not.

The Lake Okeechobee ASR Pilot and Hillsboro ASR Pilot Project Management Plans were finalized in March 2001.

Recognizing the need to address issues of a regional nature, the SFWMD and USACE initiated formulation of an ASR Regional Study in 2001.

The intended result…



…an integrated effort that addresses local and regional issues.

CERP ASR Program Status
Pilot Projects… How far along are they?

Test wells have been installed and source water characterization efforts have been initiated at the Hillsboro and Lake Okeechobee pilot sites.

These efforts have not yet been initiated at the Caloosahatchee pilot site.

On May 15, 2002, the National Environmental Protection Act (NEPA) public scoping process was initiated to gather information that will help to define issues to be addressed in a draft Environmental Impact Statement for the Hillsboro ASR Pilot Project.

CERP ASR Program Status
Pilot Projects… How far along are they?

Project management plans and monthly progress reports for each of the pilot projects can be found at:

http://www.evergladesplan.org/pm/projects/index.html

by clicking on the project of your choice.

CERP ASR Program Status
The Regional Study… How far along is it?

A draft project management plan was completed in May 2002 and is posted at:

http://www.evergladesplan.org/pm/projects/index.html

Comments are due on the draft project management plan by:

July 25, 2002

Goals and objectives of the Regional Study were developed in direct response to guidance provided by the ASR Issue Team and the CROGEE. The overarching objective of the ASR Regional Study was defined by its Project Delivery Team defined as follows:

"The ASR Regional Study will address issues beyond the scope of the ASR Pilot Projects. It will investigate regional, technical issues governing the feasibility of full-scale ASR implementation, as identified in the CERP, and its potential effect on water levels and water quality within the aquifer systems, and on existing water users, surface-water bodies, and the flora and fauna that inhabit them."

While the ASR Regional Study is intended to address regional issues associated CERP ASR, site-specific investigations are proposed where necessary to support regional investigations beyond the limited scope of ASR Pilot Projects. Development of the Regional Study scope of work has been a dynamic process with input from, but not necessarily consensus among, members of its PDT working to provide the best possible product within the time constraints provided.

The ASR Issue Team 2001 Directives…

Following production of the ASR Issue Team's 1999 report, the South Florida Ecosystem Restoration Task Force Working Group decided to keep the ASR Issue Team intact to track the progress of the CERP ASR Program and to help resolve controversies as they arise.

The ASR Issue Team has functioned well to resolve technical issues associated with implementation of CERP ASR.

In 2001, a revised ASR Issue Team directive was approved by the South Florida Ecosystem Restoration Task Force Working Group. The ASR Issue Team is now comprised of representatives from previously-participating agencies as well as the National Park Service and Florida Department of Health.

As stated in the 2001 directive,
"The ASR Issue Team shall periodically review and monitor the progress and the direction of the CERP ASR Project Delivery Teams for the pilot projects and the Regional Study regarding the resolution of issues presented in the Issue Team and CROGEE reports, or other issues that may arise during implementation."

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The ASR Issue Team 2001 Directives…

Additionally, the following guidance and deliverables were identified:

- The Issue Team shall regularly brief the Working Group on the status of the resolution of these issues. Initially, these briefings should be at least quarterly and briefly review priority issues.
- As new information is made available, the Issue Team shall prepare written materials (e.g. white paper, fact sheets, etc) for the Working Group on the status of such information and its impact to the resolution of issues regarding CERP ASR.
- The Issue Team should assist the Office of the Executive Director in developing the CERP ASR performance updates as required as part of the Task Force strategy document.
- The WG ASR Issue team will provide a forum, consistent with established CERP protocol, to facilitate achieving consensus on issues regarding ASR.
- The Issue Team shall coordinate with the Science Coordination Team on science issues related to ASR.

The ASR Issue Team 2001 directive can be found at:
http://www.sfrestore.org/issueteams/asr/2001%20asr%20directive.htm